

Effects of wildfire on aboveground and belowground biomass of a black spruce stand in interior Alaska

Kyotaro Noguchi[1]; Masako Dannoura[2]; Mayuko Jomura[3]; Yojiro Matsuura[4]

[1] FFPRI; [2] Agricultural Sci., Kobe Univ.; [3] NIAES; [4] Forest site Env., FFPRI

Black spruce (*Picea mariana*) forests are widespread in interior Alaska and they cover more than 40% of Fairbanks area. These black spruce forests are located on poorly drained north-facing slopes underlain with permafrost. In this region, wildfire is a dominant disturbance process. Although it is needed for regeneration of the black spruce forests, severe wildfire burns vegetation and reduces biomass of those forests at the same time. However, data on effects of wildfire on forest biomass in this region is still limited. In this study, we examined aboveground and belowground biomass of black spruce trees and understory shrubs and herbaceous plants at a black spruce stand, which was burned by severe wildfire in summer 2004.

In August 2005, two 16 x 16 m plots were established at a burned black spruce stand in Poker Flat Research Range of the University of Alaska, Fairbanks. Another 16 x 16 m plot was settled in an adjacent unburned black spruce stand as control. In the control plot, to estimate the aboveground and belowground (roots more than 5 mm in diameter) biomass of black spruce trees, we established allometric equations between the biomass and diameter of breast height (DBH) using four sample trees (August 2007). In the burned plot, aboveground biomass of black spruce trees (snags and logs) was estimated using another allometric equation (Jomura and Dannoura 2006); the belowground biomass was calculated based on the aboveground biomass using top/root (T/R) ratio of the trees in the control plot. Aboveground parts of understory woody and herbaceous plants were harvested from 50 x 50 cm subplots along a 16 m transect in the plot (July 2006). Fine roots less than 5 mm in diameter in the organic horizon were harvested using soil coring along the same transect (July 2006). Forest floor vegetation (mosses and lichens) were harvested from 15 x 25 cm plots (August 2005). Then, dry weights of the samples were weighed.

In the control plot, estimated aboveground and belowground biomass of black spruce was ~ 2870 and ~ 1750 g m⁻², respectively. In the burned plots, there was no live black spruce tree and estimated aboveground and belowground biomass of dead black spruce was ~ 700 and ~ 430 g m⁻², respectively. Aboveground biomass of understory woody and herbaceous plants in the burned plots was ~ 60 g m⁻², which was $\sim 30\%$ of that in the control plot (~ 200 g m⁻²). Fine root biomass in the control plot was ~ 880 and ~ 490 g m⁻² for live and dead fractions, respectively, whereas they were ~ 60 and ~ 550 g m⁻², respectively, in the burned plots. Live biomass of mosses and lichens was ~ 1400 g m⁻² in the control plot, which accounted for $\sim 20\%$ of total biomass, whereas in the burned plots, only negligible amount of live mosses were found. In summary, wildfire in summer 2004 killed most of the plants in the black spruce stand except for some understory vegetation. Our results also suggested that the wildfire reduced biomass (live + dead) of the trees, understory woody and herbaceous plants by $\sim 70\%$. However, the effects on top/root ratio of those plants were less evident, which was ~ 1.0 and ~ 0.7 for the control and burned plots, respectively.